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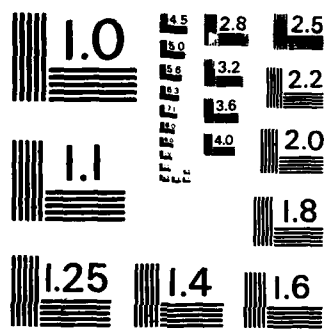
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Recommendations for the Conduct of Physical Training in Cold Weather

William L. Daniels, MAJ, MSC, Joseph Dziados, MAJ, MC

INTRODUCTION.

The need to perform strenuous physical activity in the cold has created problems for military commanders throughout the ages. Every student of history is familiar with Valley Forge and Napoleon's problems during the Russian campaign. Modern day armies have also experienced considerable problems with the cold. During World War II, 91,000 American soldiers suffered cold injuries. The fact that 87 per cent of the injuries occurred in infantry soldiers, should be of particular concern to commanders. Only 15 per cent of those injured ever returned to combat.

These figures illustrate the impact that cold injuries can have on the fighting force. How does this impact on the commander in a training situation? Simply that prevention is the key to controlling the incidence of cold injury. In all cold weather training situations, especially physical training, the commander must emphasize prevention. Prevention learned in training should carry over into the real situation.

COLD INJURIES.

There are three major types of cold injury that are of concern. These are hypothermia (low body temperature), frost bite and immersion foot or trenchfoot. Other factors besides cold can contribute to the incidence of these injuries. Wind and wetness will greatly increase the onset and incidence of cold injuries.

Hypothermia results from prolonged exposure to cold, either in air or water. The body temperature falls to levels below normal (range 95° - 75° F). As the temperature begins to reach these levels, the individual will become confused, lethargic and become unconcerned about keeping warm. As the temperature falls further, serious changes in metabolic function and activity of the heart lead to death.

Frostbite occurs when the tissues of the body become frozen due to cold exposure. The feet, hands, ears, nose and chin are the most likely sites for this to occur. The severity can range from slight with only minor injury to severe in which amputation of the affected part is required. Initial symptoms include numbness, prickling and itching. As it becomes more severe, stiffness and a burning sensation begin to occur.

Immersion foot or trenchfoot is a nonfreezing injury which occurs when soldiers are immobilized for long periods of time in a cold, wet environment. Symptoms include swelling, numbness and cramping in the legs.

It is important to note that with all these cold injuries, wetness and wind are factors that contribute to incidence and severity. Table 1 illustrates the effect that wind can have on the danger of developing cold injury. Note that immersion foot or trenchfoot can occur at any temperature. This points out the devastating effect that wet conditions can have. While it is almost impossible to establish a similar chart for the effect of wetness, it is safe to say that individuals who become wet, can expect the danger lines in this chart to shift dramatically to the left. The wetness can come not only to the environment (i.e., rain, drizzle) but also from the individual's own perspiration. Therefore, it is imperative that if someone perspires

heavily in a cold environment that they change into clean, dry clothing as soon as possible.

GO-NO GO.

For the commander who is concerned with the physical training of his troops, this all has certain ramifications. First of all, there is not a specific air temperature at which it is too cold to exercise. Breathing cold air will not injure the lungs. The dryness of cold air may cause some irritation and discomfort to the windpipe but this is not serious. The danger in cold weather to the soldier will be injury to exposed flesh, frostbite and hypothermia. Therefore, the decision to conduct physical training in cold weather should not be taken lightly. The factors that impact upon safety and comfort during cold weather training must be considered. Primary concern should be given to prevention of the cold injuries mentioned above. Incidence of cold injury can be prevented, or at least reduced, by knowing how the climate affects the body.

Temperature alone would infrequently require curtailment of training. It would be prudent to cancel or shorten outdoor training when wind chill temperatures are in the area of increasing danger in Table 1. However, if adequately dressed this should not pose a problem to brief outdoor training. Wind and rain are probably much more important environmental variables impacting upon the decision to train. This is especially true if one gets wet and then is exposed to wind.

It would be a relatively simple matter to refer to standard wind-chill charts, such as Table 1, and simply refrain from training when conditions are

in the increasing danger zone. Decision-making problems occur for training however, when conditions are in the marginal zone. Here, wind and rain become important environmental variables that impact on the decision to train.

CLOTHING.

Individual activity is a very important determinant of the amount of clothing required for personal safety and comfort in the cold. For example, when running at an 8 minute per mile pace, the average sized person burns about 15 Calories per minutes. This releases the equivalent of 3500 BTUs of heat in one hour into the space the size of the individual's body. Therefore, heat production by the exercising body is an important determinant of comfort in the cold. A sedentary individual will require more clothing than an active one. The active individual must take precautions to make sure that his (her) clothing does not become wet due to perspiration. If clothes are wet, once activity stops, rapid body cooling takes place and the conditions for chilling and possible hypothermia exist. This is a good reason for having cool-down take place in a sheltered area and enabling individuals to change into dry clothes, if possible.

When deciding on clothing for cold weather, the layering principle should be utilized. That is, several layers of clothes are generally better than one thick layer. For example, for activities like running, an inner thermal layer, such as wool or polypropylene, can be used under an insulating layer such as fiber filled vests. This should be covered by wind-resistant layers such as nylon or PTFE. This insulating layer can be removed or put back on as

the conditions require. Cotton should be avoided for cold weather wear because it has a tendency to trap moisture in the fibers.

Protection of the extremities, especially the head, feet, hands, ears and even the penis are important factors to keep in mind. Hence, gloves or mittens, watch caps, balaclavas, socks, and jock straps for males are important parts of a cold weather wardrobe. Feet are not likely to get cold while exercising vigorously, (i.e. running) unless it is very cold or they become wet. Keeping the feet dry on road marching exercises is very important in the cold. Special cold weather boots are a definite must for extended cold training. The white vapor barrier boot is a requirement for temperatures near -20°F and colder. While running is not practicle in these, marching can be done. However, special care must be taken to protect shins, heels and toes from abrasions. Frequent changes of socks and good foot hygiene are especially important in cold weather. Another helpful point for movement in the cold, such as running, is to try and start out by heading into the wind and finish with the wind at your back. That way, your confronting the wind when you're freshest and the least tired.

INDIVIDUAL DIFFERENCES.

The commander has to expect an increased injury incidence in cold weather training unless he takes preventive measures. He must also realize that there is great individual variability in the likelihood that someone will become cold injured. For example, studies have demonstrated that blacks, soldiers born in the south, and those who have had a previous cold injury are much more

likely to sustain a cold injury. Some of this susceptibility can be overcome with education and cold weather training, however, the commander's judgment must be tempered by the reality of individual variability to cold tolerance. Leaders, at all levels, right down to squad leader should be familiar with the symptoms of cold injury. It is also suggested that the individual who makes the decision to conduct, continue or terminate training be exposed to the same elements as the troops undergoing training, so that personal experience may guide expectations and idealism.

It is hoped that these guidelines, which are not meant to be hard and fast rules or regulations, will enable the commander to utilize good judgment so that maximum benefit may be gained from training time without causing needless harm to the individuals under his control.

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- TB MED 81
- NAVMED P-5052-29
- AFP 161-11

Table 1. Cooling Power of Wind on Exposed Flesh Expressed as an Equivalent Temperature (under calm conditions)

Estimated wind speed (in mph)	Actual Thermometer Reading (° F.)										
	50	40	30	20	10	0	-10	-20	-30	-40	-50
EQUIVALENT TEMPERATURE (° F.)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125
35	27	11	-4	-21	-35	-51	-67	-82	-98	-113	-129
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132
(wind speeds greater than 40 mph have little additional ef- fect.)	LITTLE DANGER (for properly clothed person) Maximum danger of false sense of security.										
	Trenchfoot and immersion foot may occur at any point on this chart.										
	INCREASING DANGER Danger from freezing of exposed flesh										
	GREAT DANGER										

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